

8. DESCRIPTION OF PROPOSED PROJECTS

8.1 General

The desired output from the Feasibility Study is a prioritized list of projects that are required through year 2030, consisting of municipal water supply facilities needed within the service area of the Northern Governorates Water Authority (NGWA). In Section 7, the comparison of alternatives has indicated that Alternative 1 is preferable, and hence Alternative 1 has been used as the basis for developing the proposed system and divide it into a phased series of projects. The proposed system defines the new transmission pipelines, reservoirs, pump stations and treatment plants required for the NGWA system as a whole. The proposed projects consist of geographic portions of the transmission system, to take into account the phased development of the transmission system, and to include the relevant requirements for rehabilitation of the existing transmission system, and installation of a centralized monitoring and control system. The proposed system description, facilities, costs, and financial aspects of the proposed projects are described below.

8.2 Description of Recommended System

8.2.1 General

The proposed system described herein is the result of further development of the Alternative 1 system presented in Section 7, taking into consideration the following:

- The changes in number and location of distribution reservoirs as provided by the WLRP, which will be presented in the Final Conceptual Design of the WLRP.
- WAJ/NGWA comments on the draft Feasibility Report.
- Notes taken from the coordination meetings held with WAJ and NGWA.

The proposed system is shown on Figures 8-1 and 8-2, which show a layout of the proposed transmission system; and a layout of the locations of the existing and new pipelines, respectively. The system is divided into transmission subsystems, described below.

8.2.2 East Transmission

With the introduction of the future potential sources of the Aqeb Wells K124 up to K140 (providing a total of 348m³/hr), the proposed eastern transmission system now starts from the Aqeb Well K140 in the Northern Badia and extends all the way to Hofa PS in the Irbid area. On the way, it passes by the existing pumping stations of Zatory and Um El-Lulu and the new proposed Mafraq pumping station.

The main water sources in the east are the wells of Aqeb, Zatory and Sumaya in addition to the Corridor wells which will be introduced into the system in 2018. The Proposed Eastern Transmission system serves Mafraq and areas in Jerash and Irbid governorates by supplying the three sub-systems described below:

Sumaya-Khaldiyeh-Zatory Sub-System: (See plan and schematic profile on **Figures 8-3 and 8-4** respectively).

This Sub-System starts from Zatory PS in Mafraq. Zatory PS collects water from the lower Aqeb (K102.5 - Zatory), Corridor, Zatory, Sumaya and some other small wells. Located at an

elevation of 655m, it pumps water to Baij and Thughrat Al Jubb Reservoirs in the Mafraq governorate. The rest of the water at Zatory is pumped in a proposed new 1000mm pipeline which downstream splits into two pipelines to make use of the latter section of the existing 600mm. These pressurized mains feed Um El-Lulu and Hofa PSs. As it passes Um El-Lulu on its way to Hofa, the pressurized pipeline is divided into two pipelines, the existing 600mm and a new 700mm.

The larger amount now taken from the Zatory Wells is pumped into the existing 600mm pipeline where it is mixed with the Mufaradat well water. The combined flow is carried in the direction of Khaldiye PS (589m) where it is boosted towards the Khaldiye reservoir at 690m.

The Sumaya wells and PS cover the shortage unmet by the local sources for the close-by reservoirs of Hamra, Swaylima and Sarhan, before conveying the remaining water to the Zatory PS.

Upper-Aqeb – Mafraq Sub-System: (See plan and schematic profile on **Figures 8-5 and 8-6** respectively).

This Sub-System, as described earlier in section 7, depends on the Upper Aqeb Wells to meet its demand. With the introduction of the new Aqeb Wells (K124-K140), the Upper Aqeb Wells now include all the wells located between K140 to K103 whose elevations range between 780 and 827m. **Figure 8-2** shows the varying diameters of pipeline sections, existing and proposed, required to carry the water from Upper Aqeb Wells to Mafraq PS/Reservoir.

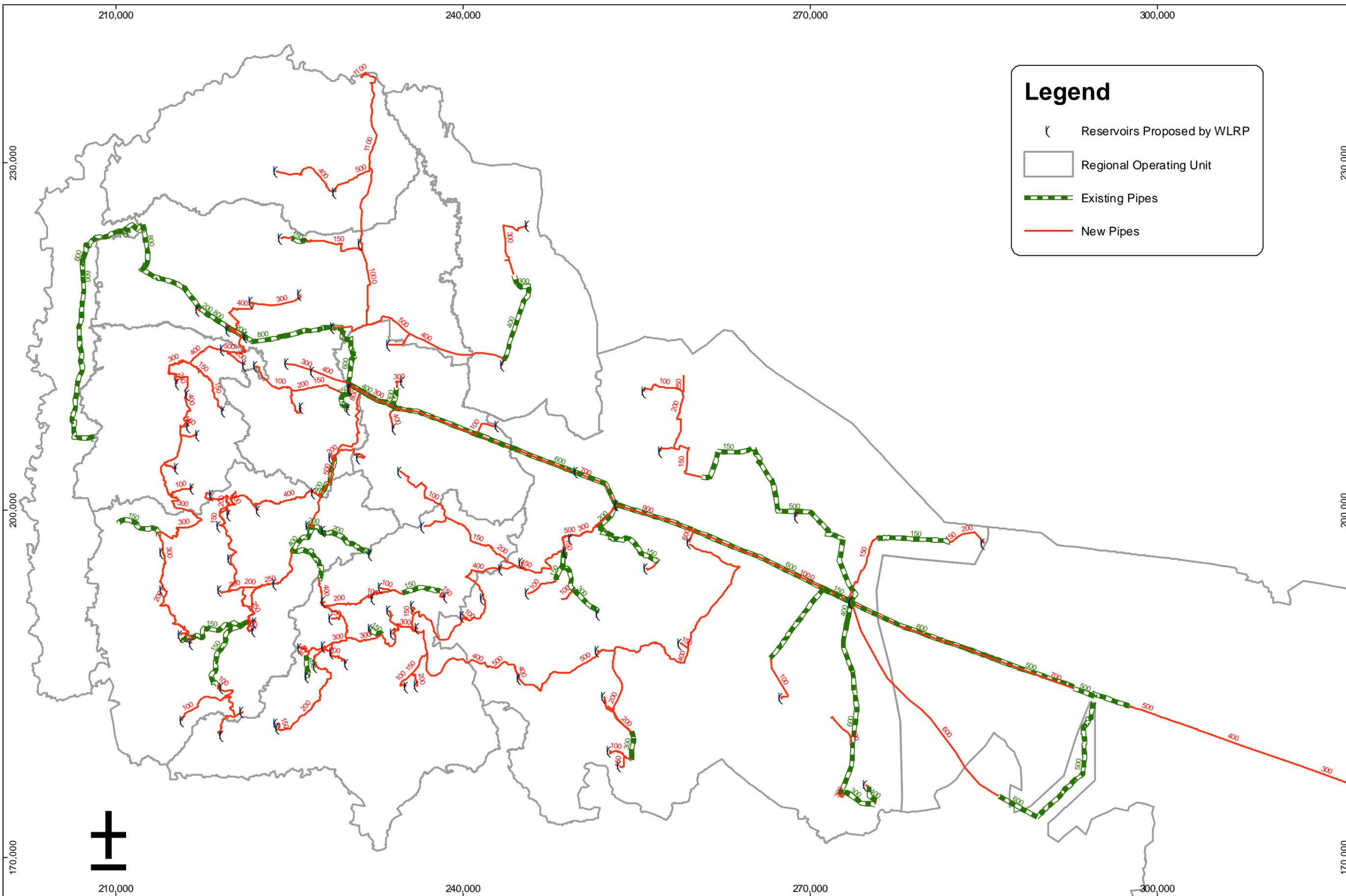
The Upper Aqeb – Mafraq Sub-System serves areas of Mafraq governorate (Hayan, Moammariyyeh, Balama and Humaid reservoirs in addition to an emergency connection serving Zniyya and Mazraa reservoirs) in addition to the 'lower pressure zones' of Jerash governorate. The proposed Mafraq PS will pump the water to Moammariyyeh Reservoir at 820m, which in turn feeds by gravity the reservoirs of Jerash Up, Jerash Down, Souf Refugee Camp, Nabi Hud and Rashadiyeh.

The subsystem as presented herein reduces power consumption by fulfilling the huge demand of Mafraq reservoir using the static head of the Upper Aqeb Wells and by eliminating the need to raise the water to Bwaydah reservoir (915m) and then releasing it to serve Jerash.

Um El-Lulu Sub-System: (See plan and schematic profile on **Figures 8-7 and 8-8** respectively).

In this Sub-System, Um El-Lulu PS (780m) pumps water into three pipelines. The first pumps to Um An Naam reservoir in an existing 200mm pipeline. The second is a new 300mm pipeline for delivering water to Bani Hasan and Bwaydah Reservoirs which in turn serve by gravity the reservoirs of Hamama and Qadam in Mafraq. While the third is a 400mm pipeline that delivers water to Dajanyeh and Abu Eiat Reservoirs in Mafraq, and Balila and No'aymeh in Bani Obaid.

Abu Eiat located at 1000m elevation supplies by gravity the remaining Mafraq reservoirs of Midwar and Nadira and those of Jerash's 'medium pressure zone' reservoirs ranging in elevation between 810m and 890m including Majar, Deir Al-Liyyat, Ketta and Nahleh reservoirs. A couple of low but distant reservoirs - Burma Up (750m) and Burma Down (650m) - are also served by the 400 mm pressure line. Using Abu Eiat Reservoir eliminates the need to construct a new pumping station at the Midwar Reservoir location as was suggested in Alternative 1, thereby reducing capital and power costs.



DRAWING SCALE: 1:300,000

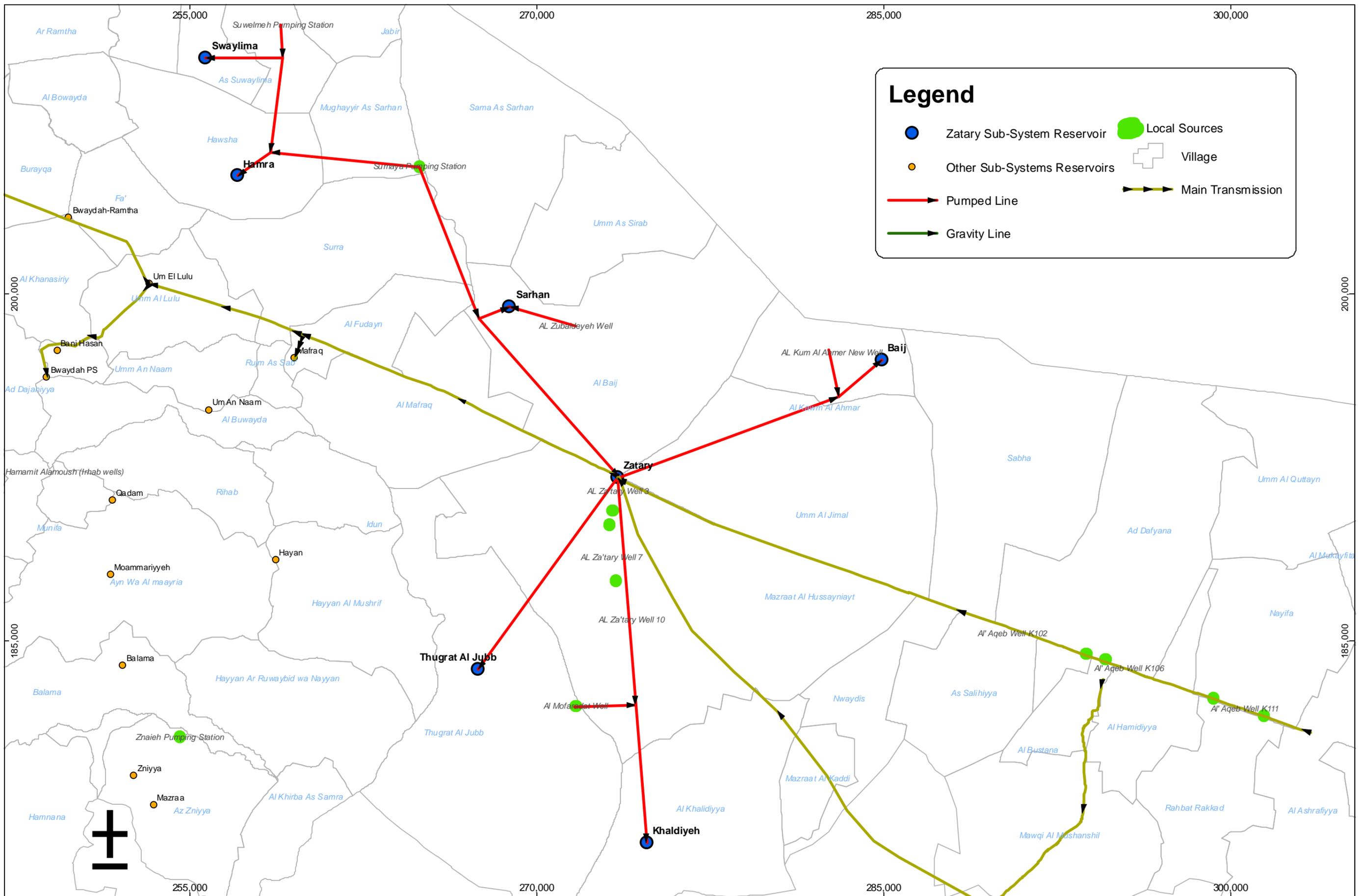
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NORTHERN GOVERNORATES WATER
 TRANSMISSION SYSTEM FEASIBILITY STUDY
 Final Proposed System Existing / New
 Pipelines Layout

PROJECT No.
 3029-42324
 FIGURE No.
 8-2



DRAWING SCALE: 1:200,000

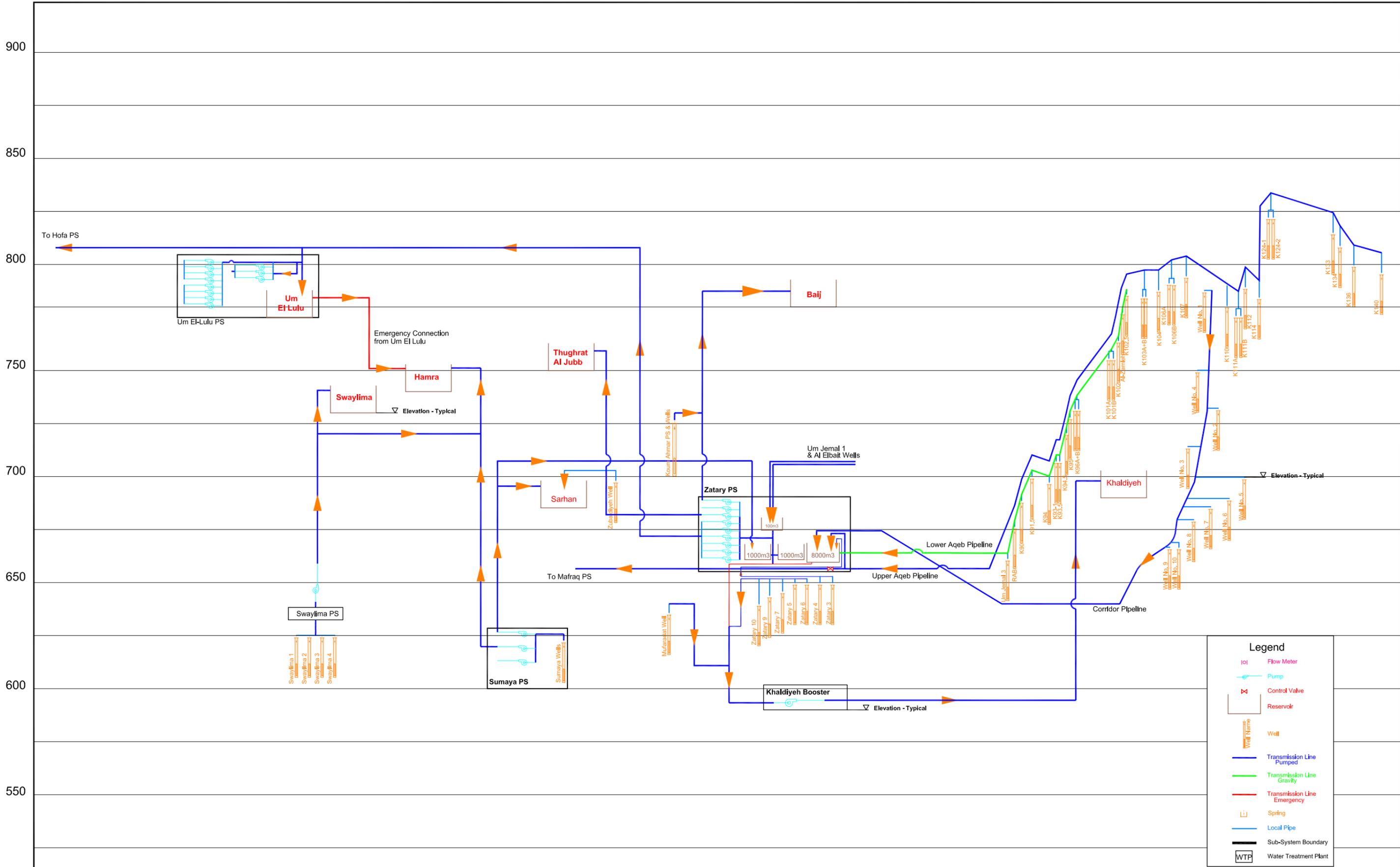
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NORTHERN GOVERNORATES WATER
 TRANSMISSION SYSTEM FEASIBILITY STUDY
 Final Proposed System: Sumaya,
 Khaldiyeh - Zatory Sub-Systems Plan

PROJECT No. :
 3029-42324
 FIGURE No.
 8-3



NOT TO SCALE

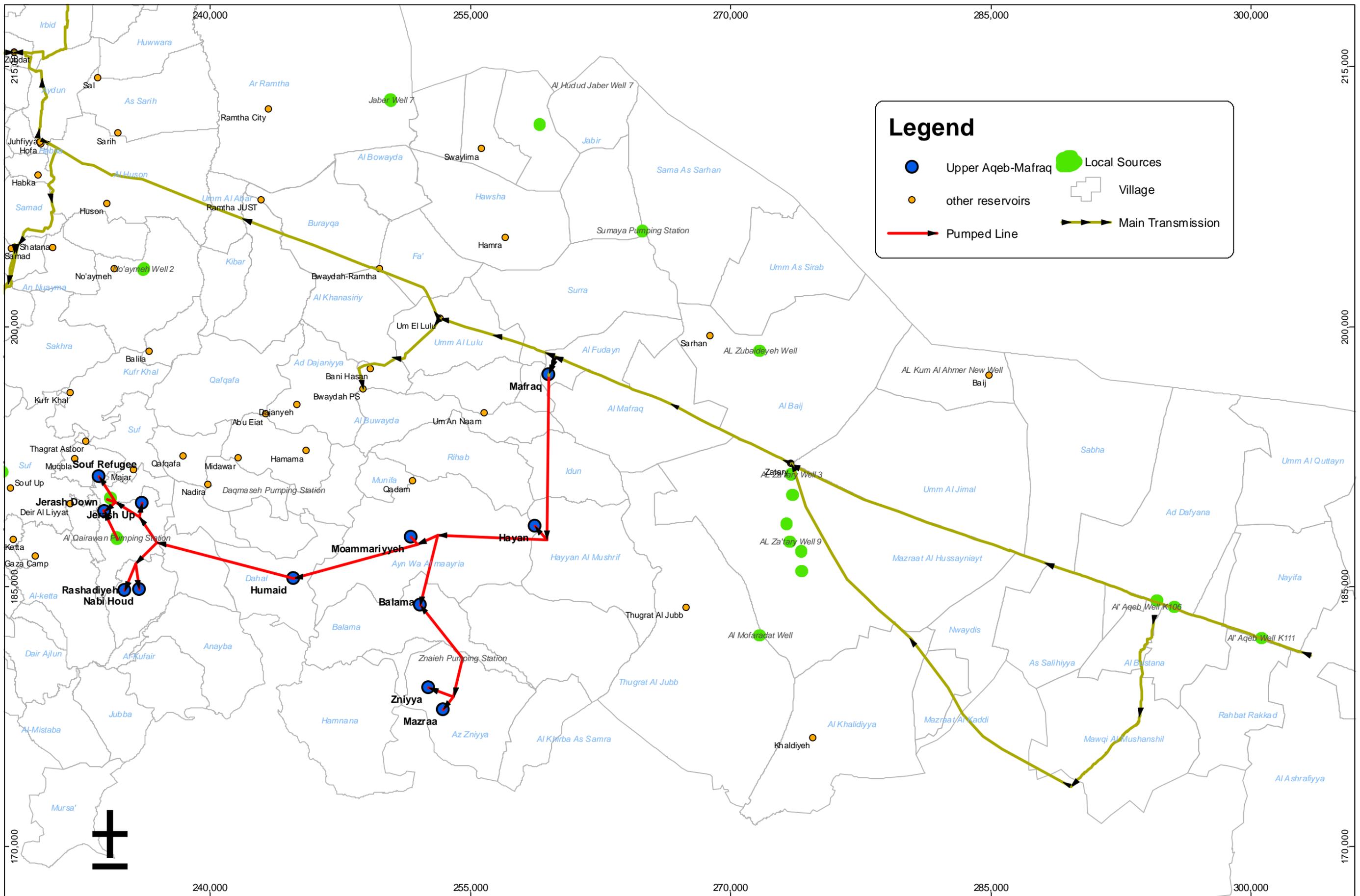
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NORTHERN GOVERNORATES WATER
 TRANSMISSION SYSTEM FEASIBILITY STUDY
 SCHEMATIC PROFILE OF PROPOSED SYSTEM
 SUMAYA-KHALDIYEH-ZATARY SUB-SYSTEM

PROJECT NO.
 3029-42324
 FIGURE NO.
 8-4



DRAWING SCALE: 1:200,000

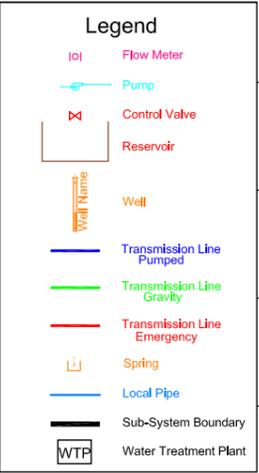
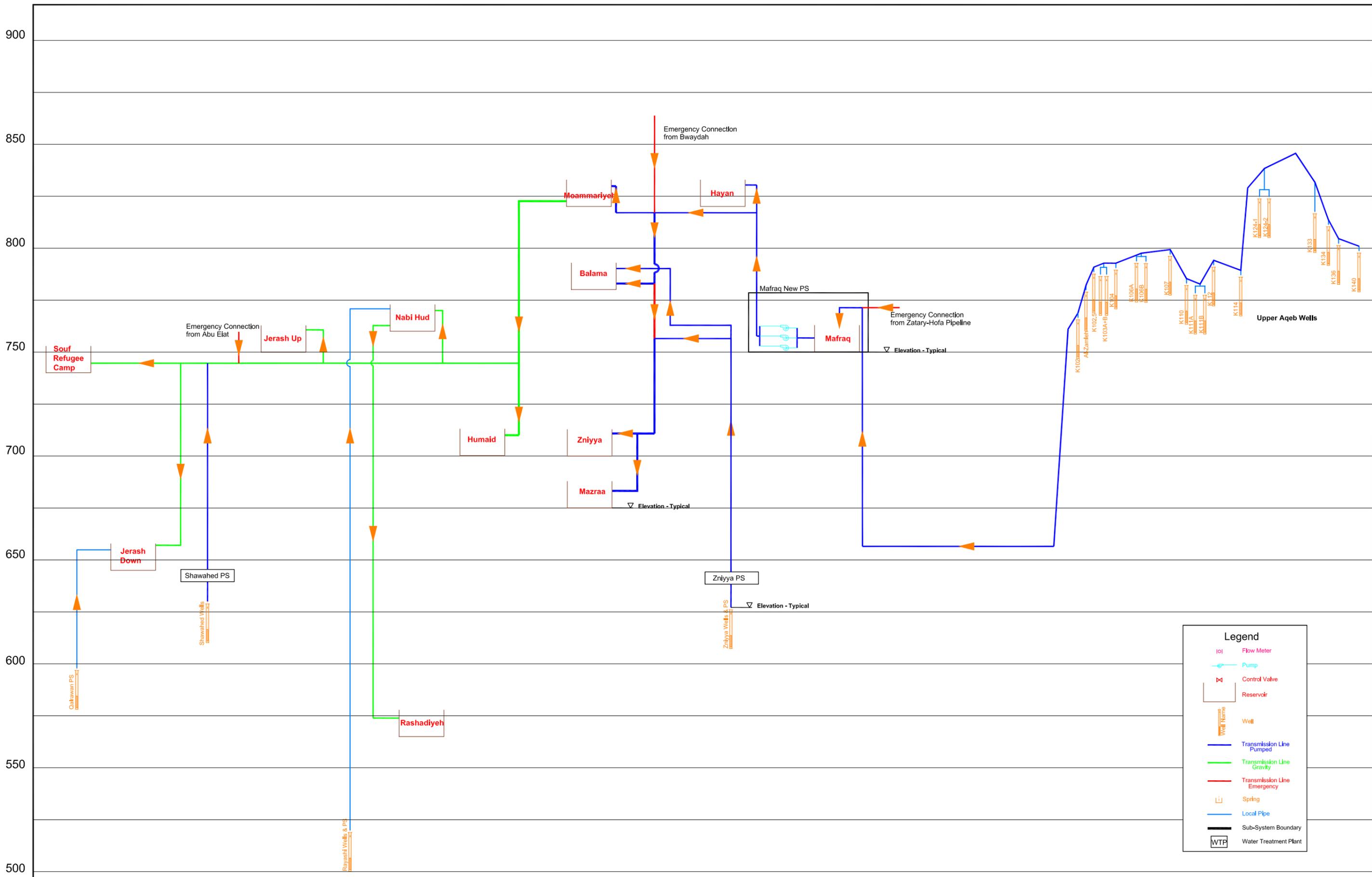
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NORTHERN GOVERNORATES WATER
 TRANSMISSION SYSTEM FEASIBILITY STUDY
 Final Proposed System: Upper Aqeb - Mafraq
 Sub-System Plan

PROJECT No. :
 3029-42324
 FIGURE No.
 8-5



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 TRANSMISSION SYSTEM FEASIBILITY STUDY
 SCHEMATIC PROFILE OF PROPOSED SYSTEM
 UPPER AQEB-MAFRAQ SUB-SYSTEM

PROJECT NO.
 3029-42324
 FIGURE NO.
 8-6